13.1 – EXOTIC PHASES OF BENT-CORE MOLECULES

Like bananas in a bunch, bent-core molecules made to pack together have difficulty organizing into phases where the spatial arrangement of the molecules is uniform. Rather they form stripes in which the packing is bouquet-like or "splayed", leading to new phases of matter exhibiting an extraordinary menagerie of beautiful twisted filament and planar structures. Applied voltage induces large polarization in these materials, making them potentially useful in display and telecom applications. The FLCMRC headed an international collaboration of liquid crystal physicists and chemists in the effort to understand this exciting new form of condensed matter.

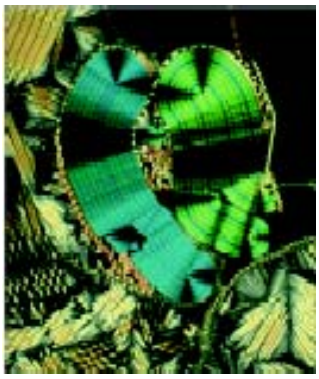

Figure: Texture of a liquid crystal phase formed by twisted filaments of molecular flowers which

13.2 – HALON LIQUID CRYSTALS

We have found liquid crystal phases in systems of particles shaped like spheres, a surprise since liquid crystal phases usually appear in molecules shaped like sticks or plates. Specifically, we have found that systems of spherical particles interacting via a hard core plus a repulsive 'soft shoulder' pair potential exhibit extraordinarily rich phase behavior, including 'lyotropic' liquid crystal phases and a variety of complex modulated crystal phases. These findings dramatically expand the range of possible modes of colloidal self-assembly, and suggest applications in the development
of novel photonic crystals and functional nanostructures.

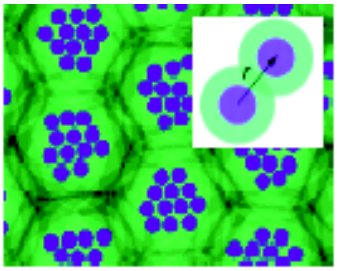

Figure: Hard discs (purple) with a soft repulsive "halo" (green) form exotic spatially modulated liquid crystal phases, one of which is shown in this
computer simulated configuration.

Figure: Students in a "Magnets and Electricity" class brought by *Materials Science from CU* to a Denver Public School.

Materials Science from CU

In this science education enrichment program FLCMRC personnel develop and present, in schools throughout the State of Colorado, hands-on classes designed to teach physical science concepts using the current understanding of materials. MSFCU presentations have been made, to over **34,000** Colorado children, more than half of whom were in either rural Colorado or metro Denver inner-city schools. The current classes include *Electronics Lab, Light, Polarization & Liquid Crystals,Light & Lasers, Magnets & Electricity, States of Matter,* and *Ups & Downs: Sports Materials*, *Molecules in Motion, Cool & Creative Chemistry,* and *Exploring the Nanoworld*.